

## **BENCHMARK COST MODEL 2**

### **Public Review Process Established**

- ✓ Sept. 1995 Joint Sponsors (Sprint, U S WEST, NYNEX, MCI) filed initial release
  - Filed in time for comment round in CC Docket 80-286
- ✓ Dec. 1995 filed data for 49 states
- ✓ Four Workshops held - 200 representatives from industry and government participated
- ✓ Comments provided in initial and reply comment rounds in CC Dockets 80-286 and 96-45.
- ✓ Based upon input received, Joint Sponsors proposed modifications in ex parte filings made 1/26/96 and 2/21/96.
- 4 BCM2 filed 7/5/96 by U S WEST and Sprint is a result of this public process.

## **BENCHMARK COST MODEL 2**

### **Misuse of Original BCM**

- ✓ Original BCM was not designed to develop the total cost of basic telephone service
- ✓ Primary intent was to identify high cost CBGs for which explicit support might be required.
- ✓ Little attention was devoted to identifying costs unique to urban environments
- ✓ Costs components which would be similar between high-cost and low-cost areas were omitted (e.g. drop, pedestal, etc.)
- ✓ BCM2 designed to enhance BCM - BCM2 reflects the total cost of providing service - BCM2 can serve as a critique of these other studies.

## **BENCHMARK COST MODEL 2**

### **CENSUS BLOCK GROUPS (CBGs)**

- Defined by U.S. Bureau of the Census
- 250 - 550 Housing Units
- Ideal Size of 400 Units

## **BENCHMARK COST MODEL 2**

### **Major Changes from BCM to BCM2:**

#### **✓ General**

- BCM2 Analysis Done for all 50 States and District of Columbia. Will be run soon for Puerto Rico, Virgin Islands and Micronesia
- Includes all Cost Elements of Basic Telephone Service
- Better Identifies Costs in Urban Environments
- Includes all Types of Loops (Including Business) by CBG
- Enhancements Provide More Flexibility and Faster Processing of the Model.

## **BENCHMARK COST MODEL 2**

### **Major Changes from BCM to BCM2 (Con't):**

- ✓ **Rural Area Specific BCM2 Enhancements**
  - Sparsely Populated Areas Treated to Remove Areas with Little or No Population
  - Loop Investments Capped to Reflect Emerging "Wireless Loop" Technology

## ***BENCHMARK COST MODEL 2***

### **Major changes from BCM to BCM2 (Con't):**

#### **✓ Overall BCM2 Enhancements:**

- Business Lines and Lines per Household added
- Distribution plant "legs" based on number of housing lots
- Structure and placing costs based on per foot costs
- Feeder plant extends into CBG where appropriate
- Investments for Drop Wire, Network Interface Device, Pedestal, Splicing, etc. added.
- Switch Module reflects five different switch sizes including remotes
- Digital Loop Carrier costs on fixed and per line basis
- Expenses developed separately for plant related and others related to lines
- Slope variable added that impacts loop length.

## **BENCHMARK COST MODEL 2**

### **Major changes from BCM to BCM2 (Con't):**

#### **✓ User Interface Changes:**

- Menu Driven
- All User Adjustable inputs consolidated - formerly hard-coded items now user adjustable
- More efficient processing
- Copper/Fiber breakpoints user selectable

## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: LOOP TECHNOLOGY**

- Distribution Plant - Analog Copper Technology
  - Fiber
- Analog Copper Feeder Where Loop Length < 9,000; 12,000; 15,000; 18,000 - User Adjustable Input
- Fiber Feeder For Digital Subscriber Line Carrier Where Loop Length > User Set Maximum
  - Remote Terminal At Feeder Plant End - May be within the CBG
- Two Types of Digital Loop Carrier Systems
  - SLC series 2000 for terminals needing capacity > 240 lines
  - AFC for terminals needing capacity < 240 lines
  - Both products utilized in drop/add configurations with SLC having total capacity of 2016 VG Channels per four fibers and AFC have total capacity of 672 VG channels per 4 fibers



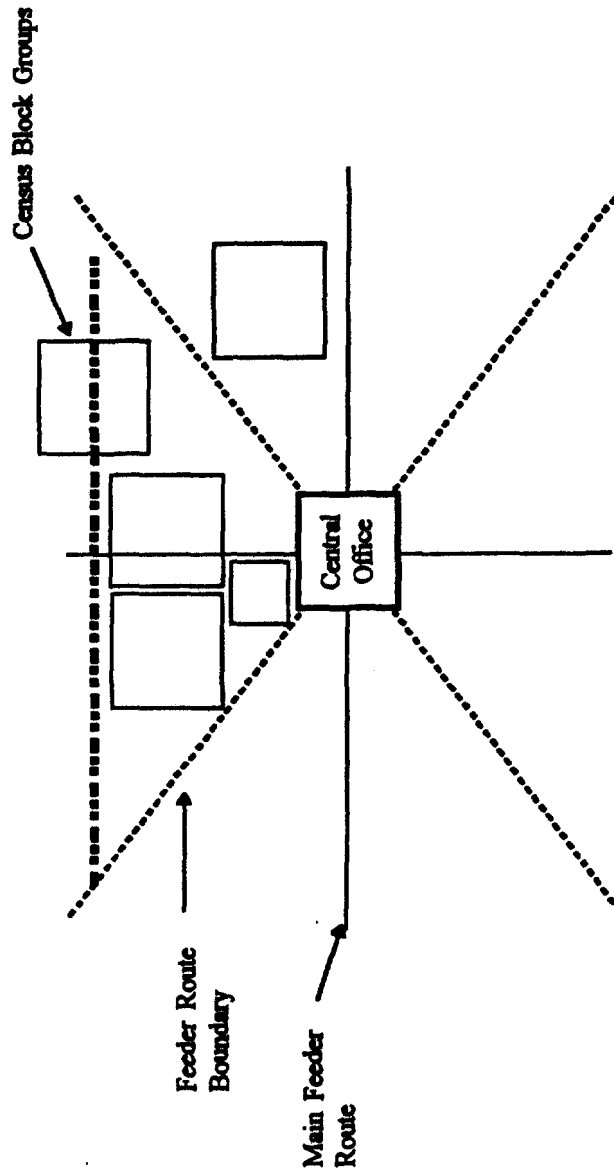
## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: FEEDER PLANT ARCHITECTURE**

- Feeder Cable Begins at CO and extends to the appropriate interface point within the CBG
- 4 Main Feeder Routes Leave CO with Feeder Route Boundaries at 45° Angle From Main Route
- Cable and Fiber Feeder Systems Share Structure In Main Feeder Systems
- Main Feeder Routes are Segmented at Taper Points
- Each Feeder Segment's Cable Size Determined By Segment Capacity
- Feeder Cable Size From 25 Pair to 4200 Pair, Fiber Cable Size from 12 Strand to 144 Strand

# BENCHMARK COST MODEL 2

## FEEDER PLANT



## **BENCHMARK COST MODEL 2**

### **Feeder Plant Changes From BCM to BCM2**

- ✓ Copper/Fiber Breakpoint is User Selectable
- ✓ Fiber May Extend into CBG to Ensure Copper Distance Does Not Exceed Copper/Fiber Breakpoint
- ✓ Smaller Copper Cable Sizes Available for Feeder
- ✓ Costs of In-Line Terminals, Cross Connects, Splicing, and Engineering Included

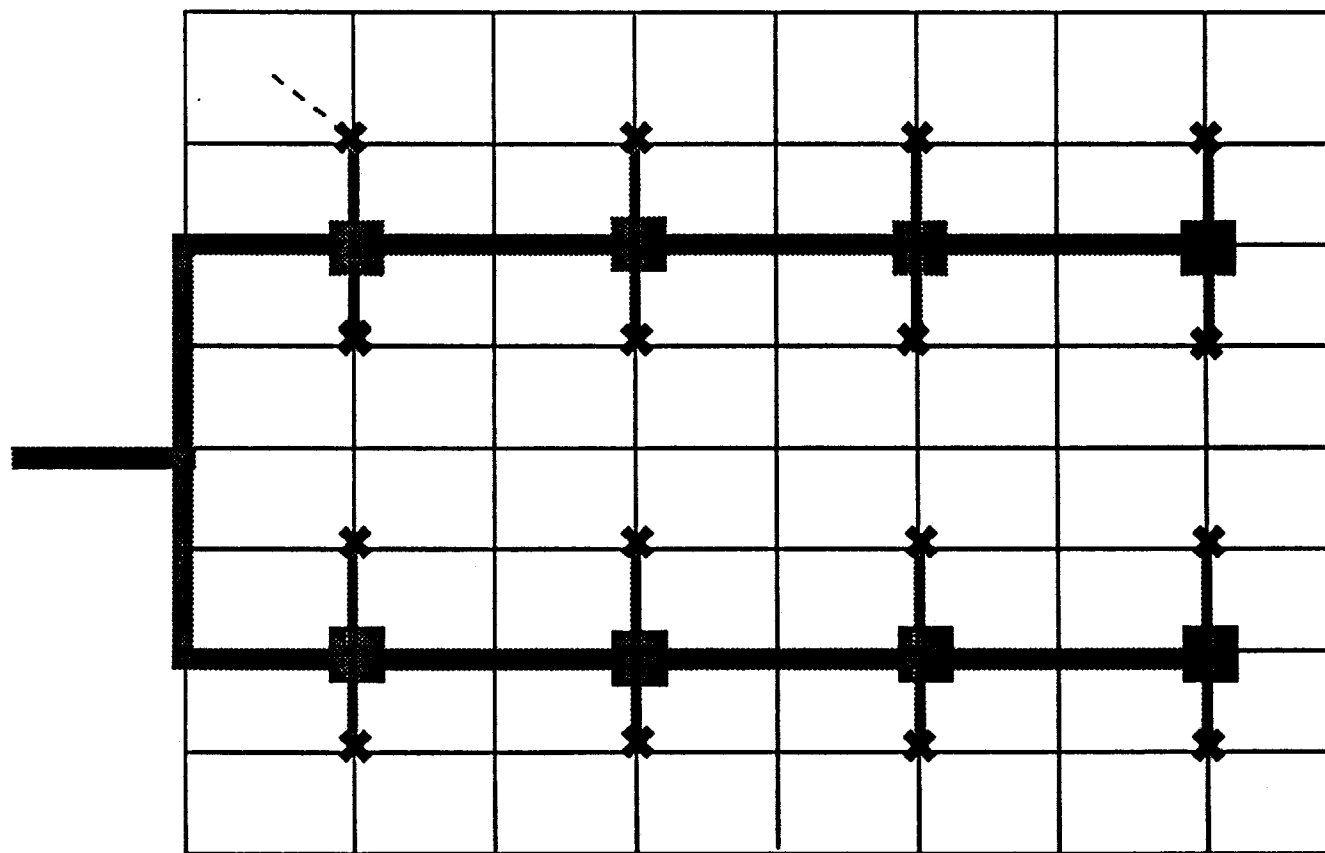
## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: DISTRIBUTION PLANT ARCHITECTURE**

- Households Are Evenly Distributed in CBG
- Distribution Cable Begins at End of Feeder and Ends at Customer Premises
- Distribution Plant Designed to Reach All Households in CBG through Placing of Cables between Subdivision Lot Lines
- Copper Distribution Length Limited at User Adjustable Maximum
- Distribution Cable Size from 12 Pair to 3600 Pair
- A Percentage of Business Lines Terminated at DS1 Level Signal
- Investments Include Network Interface Device, Drop, Pedestal, In-Line Terminals, Splicing, and Engineering
- Fiber Utilized Below Distance Breakpoint in CBGs Where Line Demand Exceeds Maximum Copper Cable Size

## BENCHMARK COST MODEL 2

### Distribution Plant with Fiber



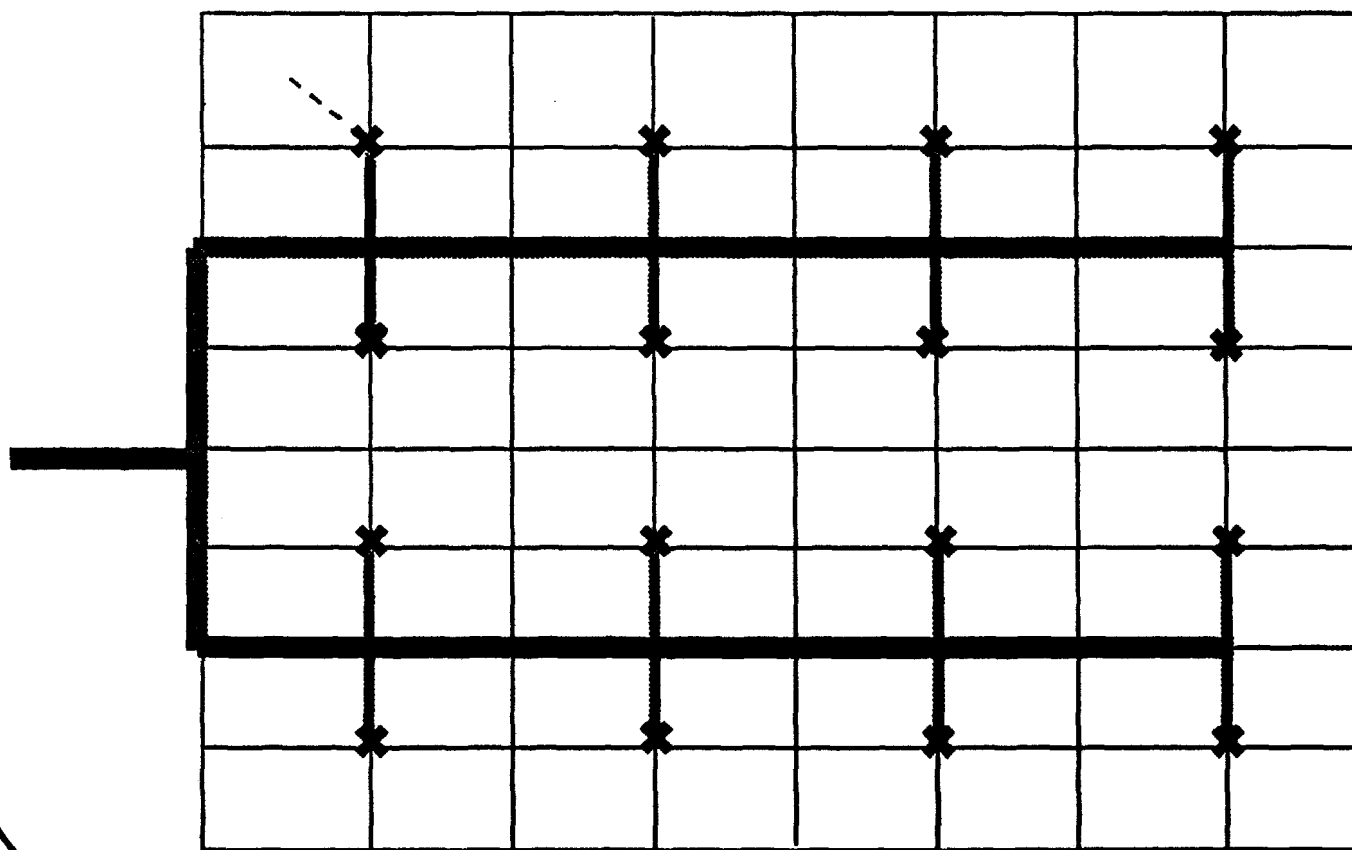
## BENCHMARK COST MODEL 2

### Distribution Plant with Copper

✕ Pedestal

■ Copper Facility

-- Drop Wire



## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: SWITCH TECHNOLOGY**

- **GENERIC DIGITAL SWITCH COSTS FOR 5 SIZE SWITCHES**
  - Remote
  - Up TO 10,000 Lines
  - 10,000 < 60,000 Lines
  - 60,000 < 100,000 Lines
  - >100,000 Lines
- **Split Between Common Costs and Per Line Costs**
- **Common Costs Include:**
  - » Central Processor Frames
  - » Billing and Data Recording Equip and Frames
  - » Misc. Power Equip and Back Up Power
  - » Main Distribution Frame
  - » Frames For Testing
  - » Basic Software

## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: DENSITY**

- Density determined by Households & Business Lines per Sq. Mile
- Determines Mixture of Aerial, Underground, & Buried Plant
- Determines Fill Factor - User Adjustable Input
- 6 Density Groupings
  - $0 < \text{And} \leq 5$
  - $5 < \text{And} \leq 200$
  - $200 < \text{And} \leq 650$
  - $650 < \text{And} \leq 850$
  - $850 < \text{And} \leq 2550$
  - 2550 +
- Density Group Determines Mix of Activities in Placing Plant and the Cost Per Foot to Place Plant - User Adjustable Input



## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: TERRAIN PLACEMENT COST**

- Placement Depths For Copper 24"; For Fiber 36" - User Adjustable Input
- Critical Water Table Depth 36" - User Adjustable
- Terrain Indicators (Originate At U.S.D.A./S.C.S.) Include:
  - Depth to Water Table
  - Depth to Bedrock
  - Hardness of Bedrock
  - Surface Soil Texture
- If Water Table or Bedrock Within Placement Depth, Then Structure Costs Reflect Additional Construction
- Otherwise, Surface Texture Examined For Plowing Difficulty

## **BENCHMARK COST MODEL 2**

### **ASSUMPTIONS: CABLE, FIBER, EQUIPMENT COSTS**

- Prices For Cable, Fiber, Switching, & Circuit Equipment Are List Prices (Non-Volume Discount)
- Separate Discounts For Cable, Fiber, Circuit Equipment & Switching -- User Adjustable Input
- Copper Cable is 24 & 26 Gauge
- Buried Cable is Armored & Filled

## ***BENCHMARK COST MODEL 2***

### **ASSUMPTIONS: STRUCTURE COSTS**

- Definition: Cost of Conduit, Innerduct, Poles etc., and Capitalized Costs of Placing Plant
- Calculated as a Cost Per Foot
- Factor Varies By Plant Type, Terrain, and Density Group
- Each Density Group and Terrain Difficulty Reflects a Different Mix of Placement Activities

## ***BENCHMARK COST MODEL 2***

### **FEEDER & DISTRIBUTION PLANT DISTANCE**

- Feeder Plant Calculations Based On Airline Distance Between CBG and Closest Central Office
- Distribution Plant Calculations Based on Size of CBGs after Using Road Network to Reduce size to Populated CBG Area
- SCS Slope Measurements Trigger Distance Adjustments
- Utilizes Tree and Branch Topology
- Determination of Quadrant For Feeder Plant

## **BENCHMARK COST MODEL 2**

### **Assumptions: Slope Impacts Loop Distance**

Minimum Slope Trigger - in Degrees - User Adjustable Input

Maximum Slope Trigger - in Degrees - User Adjustable Input

Minimum Slope Factor - Multiple Used With Calculated Distance

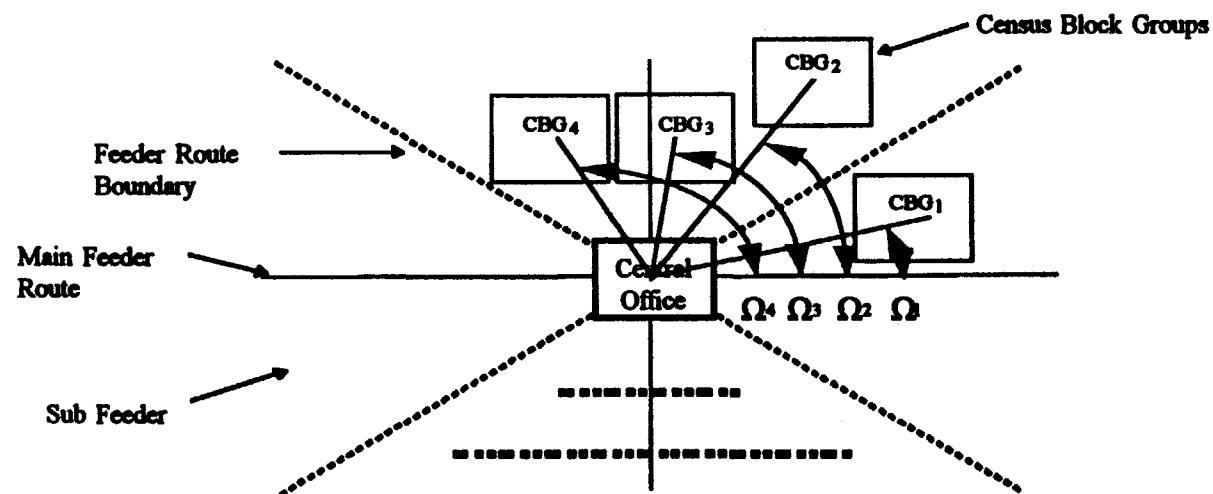
Maximum Slope Factor - Multiple Used With Calculated Distance

Combined Slope Factor - Multiple Used With Calculated Distance

User  
Adj.  
Inputs

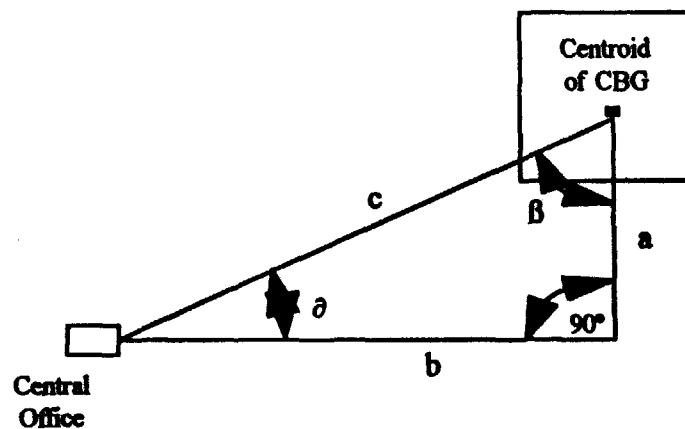
## BENCHMARK COST MODEL 2

### DETERMINATION OF FEEDER QUADRANT



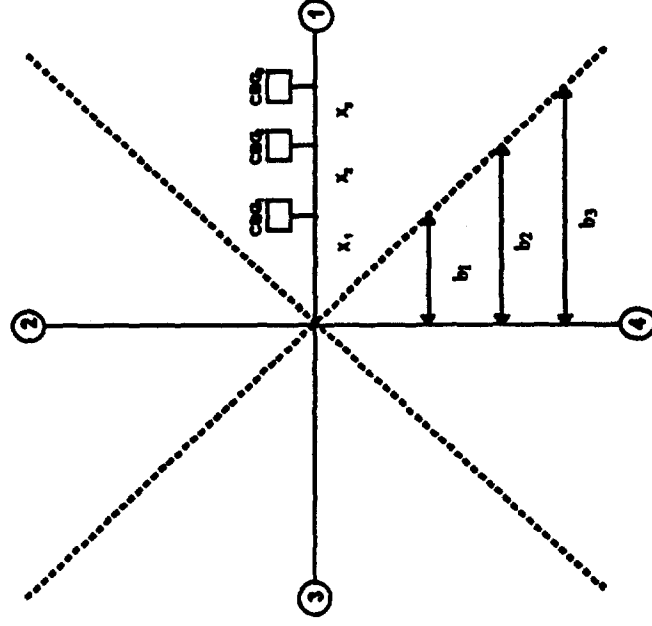
## BENCHMARK COST MODEL 2

### FEEDER DISTANCE CALCULATION



## BENCHMARK COST MODEL 2

### SHARED FEEDER DISTANCE CALCULATION





# BENCHMARK COST MODEL 2

## SEGMENT CABLE SIZE

